EXTENDED DISPLAY DEVICE

FIELD OF THE INVENTION

The present invention relates to a device to display an image. The present invention relates also to a method to display an image.

BACKGROUND OF THE INVENTION

Typically, an image-forming active region of a display unit is smaller than the physical size of the display unit. For example, a liquid crystal display comprises typically an inactive edge region of a few millimeters. The inactive edge region exists e.g. due to reasons related to mechanical construction, strength and sealing.

It may be desired that a foldable device would be capable of displaying an image which is larger than the device in its folded state. The maximum size of the displayed image is typically limited by the size of the undivided active region of a display unit, which in turn is limited by the size of the device in its folded state.

Images formed by two or more display units may be combined to form a larger image. However, the combined image is typically divided due to the inactive edge regions of the display units. Thus, the visual appearance of the image may not be satisfactory.

U.S. Pat. No. 6,486,890 discloses an apparatus for displaying images, said apparatus comprising two adjacent display screens and two magnifying lenses arranged in front of said displays in the viewing direction. The lenses are positioned at a distance upwards of the display screens such that magnified virtual images formed by the lenses are displayed without a gap between them, said virtual images constituting a larger undivided image.

Patent publication WO2004/036297A1 discloses a cover arrangement overlaying a display screen and comprising a generally planar portion and an edge portion, the latter comprising further a light-bending region. The light-bending region provides graded magnification that optimizes the viewing across a junction between display screens that have been arranged adjacent to each other.

The aforementioned prior art solutions for providing a combined image rely on altering significantly the magnification of the view in the neighborhood of the edges of the separate adjacent displays. This causes a need to manufacture optical overlay components that have graded local magnification properties, i.e. the provided magnification is different in different parts of said components. This not only complicates the manufacturing of such components, but also creates a need to have them accurately positioned with respect to the display screens.

SUMMARY OF THE INVENTION

The object of the present invention is to display a substantially undivided image by combining together images displayed by two or more display units.

According to a first aspect of the invention, there is provided a display device for displaying an image, comprising at least:

- a first display unit having a first active region to display a first primary image,
- a second display unit having a second active region to display a second primary image, said second active region and first active region being adjacent to each other but having a gap between them, and
- an image merging element adapted to form a first secondary image based on said first primary image and a second secondary image based on said second primary image,

wherein said image merging element comprises at least a first image shifting element adapted to shift and/or bend paths of light rays originating from said first primary image substantially in a first direction only in order to change, typically decrease, a visual distance between said first secondary image and said second secondary image.

According to a second aspect of the invention, there is provided a display device for displaying an image, comprising at least:

- a first display unit comprising a first active region to display a first primary image,
- a second display unit comprising a second active region to display a second primary image, said second active region and first active region being adjacent to each other but having a gap between them, and
- an image merging element adapted to form a first secondary image based on said first primary image and a second secondary image based on said second primary image, said image merging element comprising a plurality of substantially linear and parallel prisms, the prism angles of said prisms being substantially equal.

According to a third aspect of the invention, there is provided a mobile device comprising a display device for displaying an image, said display device in turn comprising at least:

- a first display unit having a first active region to display a first primary image,
- a second display unit having a second active region to display a second primary image, said second active region and first active region being adjacent to each other but having a gap between them, and
- an image merging element adapted to form a first secondary image based on said first primary image and a second secondary image based on said second primary image,

wherein said image merging element comprises at least

- a first image shifting element adapted to shift and/or bend paths of light rays originating from said first primary image substantially in a first direction only in order to change, typically decrease, a visual distance between said first secondary image and said second secondary image, and
- a second image shifting element adapted to shift paths of light rays originating from said second primary image substantially in a second direction only in order to change, typically decrease, a visual distance between said first secondary image and said second secondary image, said second direction being substantially opposite to said first direction.

According to a fourth aspect of the invention there is provided a method to display an image, said method comprising at least:

- transmitting light rays from a first active region of a first display unit to display a first primary image,
- transmitting light rays from a second active region of a second display unit to display a second primary image, said second active region and first active region being adjacent to each other but having a gap between them,
- using an image merging element to form a first secondary image based on said first primary image and a second secondary image based on said second primary image, said image merging element comprising at least a first image merging element, and
- shifting and/or bending paths of the light rays originating from said first primary image substantially in only a first